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**AQUATIC INVERTEBRATES AND HABITAT AT A FIXED
STATION ON THE BEAVERHEAD RIVER,
MADISON COUNTY, MONTANA**

July 13, 2001

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**A report to
the Montana Department of Environmental Quality
Helena, Montana**

**by
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May 2002**

INTRODUCTION

This report is one of 38 brief interpretive summaries of data assembled as part of a statewide, multi-year study conducted by the Montana Department of Environmental Quality (MT DEQ). Each report discusses information generated from a single benthic invertebrate sample collection and habitat evaluation at a fixed station established on a gauged river or high-order tributary. The present treatise focuses on the aquatic community sampled on the Beaverhead River at Twin Bridges, Montana on July 13, 2001. The sample site was located by GPS reading at 45° 32' 43" N, 112° 20' 08" W, lying within the Montana Valley and Foothill Prairie Ecoregion (Woods et al. 1998). The sample was collected by personnel of MT DEQ. Sampling effort consisted of a composite of a single Hess sample and a one-minute kicknet collection (Bukantis 1998). Habitat parameters were evaluated using the MT DEQ Macroinvertebrate Habitat Assessment Field Form for streams with riffle/run prevalence. Invertebrate samples were processed and animals identified by Rhithron Associates, Inc. Analysis of invertebrate assemblages was accomplished by applying the revised method (Bollman 1998) for streams of Western Montana's ecoregions. The method uses a multimetric battery to evaluate disturbance to biotic integrity.

The revised bioassessment metric battery and its scoring criteria have not been evaluated for application to higher-order streams and rivers; to date, no bioassessment method has been contrived for these waterways in Montana. Thus, the method used here is likely to have limitations in its applicability to the sites in this study. For example, 24 of the riverine or high-order waterways sampled for the fixed station study were located within Western Montana ecoregions and were sampled between July 23 and August 25, 2001. Mean water temperature for these sites at the time of sampling was 19.8°C (median = 19.4°). Temperatures ranged from 15.5°C (Kootenai River near Libby) to 25.3°C (Jefferson River near Three Forks). Ninety-eight sites from Western Montana were used to assemble the revised metric battery and to test it for sensitivity in detecting impairment, to establish scoring criteria, and to improve robustness of bioassessment. These 98 sites were mainly second and third order streams; the sampling season roughly corresponded to that of the fixed-station study. Mean water temperature for these sites at the time of sampling was 15°C (median = 14°C). Natural variations in benthic community composition and structure along longitudinal and thermal gradients are well known phenomena. Thus, scores and classifications were established for much smaller systems with significantly lower water temperatures; impairment classifications and use support designations in this study must be interpreted with care. Results from the application of other metric batteries may be found in the Appendix.

RESULTS AND DISCUSSION

Table 1 itemizes the nine evaluated habitat parameters and shows the assigned scores for each, as well as the integrated score and condition category.

Overall habitat condition scored sub-optimally. The riffle was perceived to be marginally developed, and benthic substrate was judged monotonous. Substrate particles were rated as moderately embedded, and some fine sediment deposition was noted. Small areas of rip-rap altered the right bank. The left bank of the river was observed to be eroding badly; a park was located on this side of the river, with grassy banks and obvious disruption of vegetative cover. The right bank did not exhibit erosion, and willows and

other vegetation protected that streambank well. The riparian zone width was somewhat limited on both sides of the channel.

Flow conditions were judged optimal.

Table 1. Stream and riparian habitat assessment for a fixed station on the Beaverhead River, July 2001.

Max. possible score	Parameter	Beaverhead River at Twin Bridges
10	Riffle development	5
10	Benthic substrate	4
20	Embeddedness	6
20	Channel alteration	14
20	Sediment deposition	15
20	Channel flow status	19
20	Bank stability: left / right	2 / 9
20	Bank vegetation: left / right	2 / 10
20	Vegetated zone: left / right	8 / 6
160	Total	100
	Percent of maximum CONDITION*	62.5 SUB-OPTIMAL

*Condition categories: Optimal > 80% of maximum score; Sub-optimal 75 - 56%; Marginal 49 - 29%; Poor <23%. Adapted from Plafkin et al. 1998.

Table 2. Metric values, scores, and bioassessment for a fixed station on the Beaverhead River. The revised bioassessment metric battery (Bollman 1998) was used for the evaluation. July 2001.

	Beaverhead River at Twin Bridges	
METRICS	METRIC VALUES	METRIC SCORES
Ephemeroptera richness	4	2
Plecoptera richness	0	0
Trichoptera richness	5	3
Number of sensitive taxa	0	0
Percent filterers	16.5	1
Percent tolerant taxa	61.5	0
	TOTAL SCORE (max.=18)	6
	PERCENT OF MAX.	33
	Impairment classification	MODERATE
	USE SUPPORT	PARTIAL

Bioassessment results are given in Table 2. When this bioassessment method is applied to these data, scores indicate that this site on the Beaverhead River is moderately impaired and only partially supports designated uses.

The elevated biotic index value (5.16) and low mayfly taxa richness suggest that water quality may have been impaired by warm temperatures or nutrient enrichment. Since the measured water temperature at the time of sampling was 18.1°C, which is below the mean of other riverine sites visited for the fixed stations study, nutrient enrichment seems the more likely impact. Enrichment also seems to be indicated by the abundance of the caddisfly *Hydrotilla* sp., which is typically associated with beds of filamentous algae. In addition to blooms of filamentous algae, nutrient enrichment can also be associated with anoxic sediments, which appear to be present at this site, since hemoglobin-bearing chironomids *Chironomus* sp., *Cryptochironomus* sp., *Microtendipes* sp. and *Phaenopsectra* sp. were all present in the collection. Sixty-one percent of animals in the assemblage were tolerant to saprobic conditions.

Twelve “clinger” taxa and 5 caddisfly taxa were present, suggesting that fine sediment deposition may have created some limitations to available hard substrate habitats at the site. Twenty-four percent of the fauna were in taxa oriented toward fine sediment. The absence of stoneflies may have resulted from water quality impairment, but may also have been associated with disruptions to reach-scale habitat features such as streambank stability, channel integrity, or riparian zone function.

All expected functional components were represented in the sample, but predators were extremely rare, suggesting a dearth of instream habitat diversity or availability. Scrapers were also somewhat limited in numbers; this may reflect habitat limitation by embeddedness, fine sediment deposition, and/or filamentous algae contamination.

CONCLUSIONS

- Evidence of degraded water quality by nutrient enrichment can be discerned in the data.
- Limited benthic habitats may limit the predator and scraper fauna. Fine sediment deposition, embeddedness of substrate, and/or filamentous algae blooms may be associated with instream habitat limitations.
- While the impairment classification assigned to the site appears to be appropriate given the tolerance characteristics and taxonomic composition of the assemblage, the bioassessment score appears to over-estimate impairment. In particular, the contribution of filter-feeders seems to be appropriate for a riverine environment, and the proportion of tolerant taxa is only moderately elevated over expectations for the site.

LITERATURE CITED

Bollman, W. 1998. Improving Stream Bioassessment Methods for the Montana Valleys and Foothill Prairies Ecoregion. Master's (M.S.) Thesis. University of Montana. Missoula, Montana.

Bukantis, R. 1998. Rapid bioassessment macroinvertebrate protocols: Sampling and sample analysis SOP's. Working draft, April 22, 1997. Montana Department of Environmental Quality. Planning Prevention and Assistance Division. Helena, Montana

Woods, A.J., Omernik, J. M. Nesser, J.A., Shelden, J., and Azevedo, S. H. 1999. Ecoregions of Montana. (Color poster with map, descriptive text, summary tables, and photographs): Reston, Virginia. US Geological Survey.

APPENDIX

Taxonomic data and summaries

Beaverhead River

July 2001

Aquatic Invertebrate Taxonomic Data

Site Name: Beaverhead River at Twin Bridges

Date: 7/13/01

Site ID: M08BEAVR01

Approx. percent of sample used: 4

Taxon	Quantity	Percent	HBI	FFG
Imma. Tubificid with cap. setae	6	1.76	10	CG
Sphaeriidae	2	0.59	8	CF
Physidae	14	4.12	8	SC
<i>Acari</i>	2	0.59	5	PA
Total Misc. Taxa	24	7.06		
<i>Acentrella turbida</i>	1	0.29	4	CG
<i>Baetis tricaudatus</i>	70	20.59	4	CG
<i>Leptophlebia</i> sp.	1	0.29	3	CG
<i>Tricorythodes minutus</i>	61	17.94	4	CG
Total Ephemeroptera	133	39.12		
<i>Brachycentrus occidentalis</i>	14	4.12	2	CF
<i>Helicopsyche borealis</i>	3	0.88	3	SC
<i>Hydropsyche</i> sp.	6	1.76	5	CF
<i>Hydroptila</i> sp.	43	12.65	6	PH
<i>Mayatrichia</i> sp.	2	0.59	6	SC
Total Trichoptera	68	20.00		
<i>Hygrotus</i> sp.	1	0.29	5	PR
<i>Optioservus</i> sp.	10	2.94	5	SC
<i>Zaitzevia</i> sp.	1	0.29	5	CG
Total Coleoptera	12	3.53		
<i>Hemerodromia</i> sp.	1	0.29	6	PR
<i>Simulium</i> sp.	30	8.82	5	CF
Total Diptera	31	9.12		
<i>Chironomus</i> sp.	3	0.88	10	CG
Cricotopus (Cricotopus) Gr.	3	0.88	7	CG
Cricotopus Trifascia Gr.	22	6.47	7	CG
<i>Cryptochironomus</i> sp.	1	0.29	8	PR
Eukiefferiella Devonica Gr.	4	1.18	8	CG
<i>Microtendipes</i> sp.	3	0.88	6	CF
<i>Orthocladius</i> sp.	12	3.53	6	CG
<i>Parametrioctenemus</i> sp.	3	0.88	5	CG
<i>Paratanytarsus</i> sp.	2	0.59	6	UN
<i>Phaenopsectra</i> sp.	1	0.29	7	SC
<i>Polypedilum</i> sp.	2	0.59	6	SH
<i>Synendotendipes</i> sp.	10	2.94	6	CG
<i>Tanytarsus</i> sp.	1	0.29	6	CF
Thienemannimyia Gr.	1	0.29	5	PR
<i>Tvetenia</i> sp.	4	1.18	5	CG
Total Chironomidae	72	21.18		
Grand Total	340	100.00		

Aquatic Invertebrate Summary

Site Name: Beaverhead River at Twin Bridges

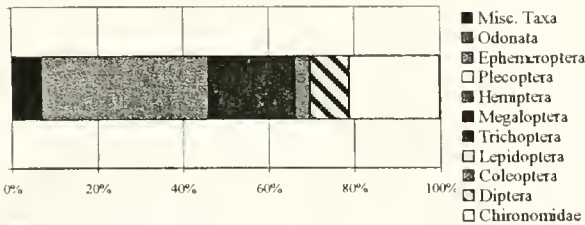
Date: 7/13/01

SAMPLE TOTAL 340

EPT abundance	201
TAXA RICHNESS	33
Number EPT taxa	9
Percent EPT	59.12

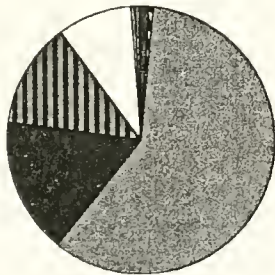
TAXONOMIC COMPOSITION

GROUP	PERCENT	#TAXA	ABUNDANCE
Misc. Taxa	7.06	4	24
Odonata	0.00	0	0
Ephemeroptera	39.12	4	133
Plecoptera	0.00	0	0
Hemiptera	0.00	0	0
Megaloptera	0.00	0	0
Trichoptera	20.00	5	68
Lepidoptera	0.00	0	0
Coleoptera	3.53	3	12
Diptera	9.12	2	31
Chironomidae	21.18	15	72



FUNCTIONAL COMPOSITION

GROUP	PERCENT	#TAXA	ABUNDANCE
Predator	1.18	4	4
Parasite	0.59	1	2
Gatherer	59.12	14	201
Filterer	16.47	6	56
Herbivore	0.00	0	0
Piercer	12.65	1	43
Scraper	8.82	5	30
Shredder	0.59	1	2
Xylophage	0.00	0	0
Omnivore	0.00	0	0
Unknown	0.59	1	2



- Predator
- Parasite
- Gatherer
- Filterer
- Herbivore
- Piercer
- Scraper
- Shredder
- Xylophage
- Omnivore
- Unknown

COMMUNITY TOLERANCES

Sediment tolerant taxa	3
Percent sediment tolerant	23.82
Sediment sensitive taxa	0
Percent sediment sensitive	0.00
Metals tolerance index (McGuire)	4.37
Cold stenotherm taxa	0
Percent cold stenotherms	0.00

Site ID: M08BEAVR01

DOMINANCE

TAXON	ABUNDANCE	PERCENT
<i>Baetis tricaudatus</i>	70	20.59
<i>Tricorythodes minutus</i>	61	17.94
<i>Hydroptila</i> sp	43	12.65
<i>Simulium</i> sp	30	8.82
Cricotopus Trifascia Gr	22	6.47
SUBTOTAL 5 DOMINANTS	226	66.47
Physidae	14	4.12
<i>Brachycentrus occidentalis</i>	14	4.12
<i>Orthocladus</i> sp	12	3.53
<i>Optoservus</i> sp	10	2.94
<i>Synendotendipes</i> sp	10	2.94
TOTAL DOMINANTS	286	84.12

SAPROBITY

Hilsenhoff Biotic Index	5.16
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DIVERSITY

Shannon H (loge)	2.64
Shannon H (log2)	3.80

Simpson D

	0.11
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VOLTINISM

TYPE	ABUNDANCE	PERCENT
Multivoltine	145	42.50
Univoltine	170	49.85
Semivoltine	26	7.65

TAXA CHARACTERS

	#TAXA	ABUNDANCE	PERCENT
Tolerant	12	209	61.47
Intolerant	0	0	0.00
Clinger	12	137	40.29

BIOASSESSMENT INDICES

B-IBI (Karr et al.)

METRIC	VALUE	SCORE
Taxa richness	33	3
E richness	4	1
P richness	0	1
T richness	5	3
Long-lived	3	3
Sensitive richness	0	1
%tolerant	61.47	1
%predators	1.18	1
Clinger richness	12	3
%dominance (3)	51.18	3
TOTAL SCORE		20
		40 %

MONTANA DEQ METRICS (Bukantus 1998)

METRIC	VALUE	Plains Ecoregions	Valleys and Foothills	Mountain Ecoregions
Taxa richness	33	3	3	3
EPT richness	9	3	0	0
Biotic Index	5.16	2	1	0
%Dominant taxon	20.59	3	3	3
%Collectors	75.59	2	1	1
%EPT	59.12	3	2	2
Shannon Diversity	3.80	3		
%Scrapers + Shredd	9.41	1	0	0
Predator taxa	4	2		
%Multivoltine	42.50	2		
%H of T	8.8		3	
TOTAL SCORES		24	13	9
PERCENT OF MAXIMUM		80.00	54.17	42.86
IMPAIRMENT CLASS		SLIGHT	SLIGHT	MODERATE

Montana DEQ metric batteries

